

Unsupervised Classification of Radar Imagery of Wetlands
Using the Soft Competition Scheme

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Abstract

Wetlands are important for a variety of reasons. Northern wetlands, for example, may produce large fluxes of methane. Tropical wetlands play an important role in the breeding of disease-carrying insects. Synthetic aperture radar (SAR) has been shown to be sensitive to vegetation type and to presence or absence of surface water. Because of the potential utility of SAR in identifying wetlands, we consider the problem of classifying radar imagery of areas containing wetlands. Many radar classification algorithms are supervised; that is, they need training information. Such information normally consists of the radar signature of each class. In many applications, however, this information is at best time consuming to obtain and at worst simply not available. Hence, we consider unsupervised classification instead.

We use a method from the field of vector quantization in which one looks for optimal codebooks to represent data. This problem is identical to that of unsupervised classification, and we apply a vector quantization method called the Soft Competition Scheme to our problem. Many clustering algorithms, such as the k-means algorithm and the self-organizing feature map perform a hard classification at each iteration, meaning that each data point is classed as one and only one of the classes existing at that step. Better results can be obtained by using so-called soft classification, in which the each data point can have more than one class or a combination of class characteristics associated with it. This is the case for the Soft Competition Scheme (SCS). After the SCS clustering is completed, the class statistics are used in a maximum a posteriori (MAP) statistical classifier, which maximizes the probability density function of the pixel labels conditioned on the radar observations. We demonstrate the results on data from Alaska and show comparison with previously published results using supervised classification. We also show application of the unsupervised approach to data acquired in Belize, Central America.